

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF THE PROBLEM

Cellulose is one of the most abundant biopolymer source in Malaysia and it can be extracted by low cost method (Miao et al., 2016). It is composed of a long chain of glucose molecules, normally known as polysaccharide. These chains are bonded by hydrogen bond and arranged together in parallel arrays to form cellulose microfibrils (Miao et al., 2016). Thus, the structure form as crystalline. The number of chains present in microfibrils gave effect to the complexity of the structure (Thomas et al., 2013). There has increased interest toward cellulose due to its renewability and stability (Miao et al., 2016). Furthermore, it has been reported that cellulose materials are nontoxicity and biodegradability (Gong et al., 2009). Thus, it can be used in many applications such as tissue engineering, drug delivery, water filter, sensors and energy storage.

Carboxymethyl cellulose (CMC) contains a hydrophobic polysaccharide backbone and many hydrophilic carboxyl groups, hence shows amphiphilic characteristics (Su et. al., 2010). It's becoming one of natural water-soluble cellulose derivatives that have no harmful effects on human health. It is widely used in stabilizing food, emulsifier as well as to control enzyme activities (Su et al., 2010). CMC can be obtained by synthetization of alkali-catalyzed reaction of cellulose with chloroacetic acid. The polar carboxyl group present in the structure make it soluble and chemically reactive.

Nowadays, there are lots of technology that have been invented in producing nanofibers material such as phase separation, template and electrospinning method.

Fibrous materials have many advantages compared to bulk counterpart due to their present in high area/volume ratio and tunable porosity (Martinez et al., 2016). Among others method, electrospinning method has gained many attention among researcher due to its ability to get smooth nanofibers. It has been used to produce considerable amount of nanofibrous materials based on natural and synthetic polymers with fiber morphology and specific physicochemical properties (Martinez et al. 2016). There are 3 major parameters covered by electrospinning method which are (i) solution parameters (viscosity, surface tension, conductivity/surface charge density), (ii) ambient parameters (humidity and temperature), and (iii) process parameters (voltage, flow rate, collectors and also the distance between collector and the tip of the syringe). (Li & Wang, 2013) . Each of the parameter give a significant affect to the result of morphology and diameters of the fibers.

This research has proposed to study the effect of silver nanoparticles on CMC nanofibers material based on green chemistry approach by using water as the only solvent. Products consist of silver nanoparticles have been approved by accredited agencies including the U. S. FDA, U. S. EPA, SIAA of Japan, Korea's Testing and Research Institute for Chemical Industry and FITI Testing & Research Institute. From the past study, they are using chemical reduction methods which are expensive, hazardous to environment and required harmful UV light or microwave radiation during the preparation (Meng, 2015). Hence, further research should be conducted with more eco-friendly method. The advantages of green chemistry approach include cost saving, reduce consumption of energy, decrease reaction time and considerable reduction time in reactor size (Jeon et al., 2005). Thus, green chemistry approach has been practiced during this experiment by concerned the matters on the surrounding issues. Then, the properties of the fiber are characterized by using SEM, FESEM, ATR- FTIR, UV-vis, and TGA.

1.2 STATEMENT OF THE PROBLEM

Demand on non-toxicity, cost effective and safe polymeric materials for various industrial applications.

1.3 OBJECTIVES OF THE STUDY

The objectives of this study are:

- i. To study the effect of Silver nanoparticles in Carboxymethyl - Cellulose nanofibers.
- ii. To identify physical and thermal properties of fabricated nanofibers.

1.4 SCOPE OF STUDY

To achieve first objective, the scope of study are:

- i. To optimize the parameters of electrospinning including solution parameters, process parameters and ambient parameters.
- ii. To synthesized varied amount of silver nanoparticles at constant concentration of Carboxymethyl-cellulose.

To achieve second objective, the scope of study are:

- i. To observe the crystalline and morphological features of AgNPs/CMC/PVA nanofibers by using scanning electron microscope (SEM) and field emission scanning electron microscope (FESEM).
- ii. To study the thermal properties of AgNPs/CMC/PVA nanofibers by using thermogravimetric analysis (TGA).
- iii. To identify the existed bond of AgNPs/CMC/PVA by using Attenuated Total Reflectance-Fourier transform infrared spectroscopy (ATR-FTIR).
- iv. To obtain the particles size distribution of AgNPs/CMC/PVA by using Ultraviolet-Visible Spectroscopy (UV-Vis).